CONTRIBUTIONS FROM THE LABORATORY OF VERTEBRATE GENETICS

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

NUMBER 12 SEPTEMBER, 1939

VARIATION IN THE DEER-MOUSE (*PEROMYSCUS MANICULATUS*) IN THE COLUMBIA BASIN OF SOUTHEASTERN WASHINGTON AND ADJACENT IDAHO AND OREGON

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INTRODUCTION

THIS report describes the variation in dimensions and in pelage color of eleven stocks of deer-mice (*Peromyscus maniculatus*) from that part of the Columbia Basin lying in southeastern Washington and the adjacent parts of Idaho and Oregon. This is a region of considerable ecological diversity, for three more or less distinct life belts or biotic areas occur, the limits of which are determined largely by the elevation above sea level (Dice, 1916: 294–96). Along the Columbia River at Wallula the elevation is about three hundred feet, while one peak of the Wallowa Mountains in northeastern Oregon rises to more than nine thousand feet. The vegetation at Wallula is dominated by sagebrush. The forests of the higher mountains are composed largely of conifers, although some habitats in these mountains are decidedly arid. Bunch grass forms the characteristic vegetation of the wide intermediate belt.

Of the eleven collecting stations from which the stocks of deer-mice for this study were taken, Wallula lies in the sagebrush belt; Prescott and Palouse Falls are in the bunch-grass belt; Lyons Ferry North and Lyons Ferry South also are in the bunch-grass belt, but in the hot dry canyon of Snake River; Pullman is in the bunch-grass belt, almost at the border of the montane belt; Dayton is assigned to the montane belt, but is close to the bunch-grass transition; and Troy, Hompeg Falls, Godman, and Lick Creek are in the montane belt of the mountains.

Snake River bisects the area covered by the study and joins the Columbia River only a few miles above Wallula. This broad swift stream is a definite barrier to the distribution of small mammals, although the same species of deer-mouse occurs on each side of the river. Furthermore, for most of its distance in the area Snake River flows in a deep canyon, the bottom of which is much hotter and more arid than are the bunch-grass-covered plateaus on each side.

ACKNOWLEDGMENTS

The expedition on which the collections of 1928 were made was supported in part by the William P. Harris, Jr., Research Fund of the Museum of Zoology. The expedition of 1932 was supported in part by a grant from the Carnegie Institution of Washington.

The care for the experimental animals for the years before 1932 was provided by the Museum of Zoology of the University of Michigan, aided by grants from the Faculty Research Fund. Since 1932 the animals have been cared for by the Laboratory of Vertebrate Genetics. Assistants furnished by the National Youth Administration have made part of the necessary measurements.

The publication of this report has been made possible by a grant from the Horace H. Rackham School of Graduate Studies.

METHODS OF STUDY

The mice captured at each of the collecting stations were shipped to the University of Michigan at Ann Arbor. The laboratory-bred offspring were all kept in the same rooms and all were fed the same standard ration. When, in the spring of the year, these laboratory-bred mice had reached an approximate age of one year they were killed by ether, measured immediately, and their skins and bones prepared in a standard manner for specimens. It is believed, therefore, that the differences between the several stocks in dimensions and in pelage color are chiefly caused by differences in the heredity of the populations from which the original stocks were taken.

The methods of taking the measurements and color readings for this study are the same as have been employed in my previous studies of *Peromyscus* (Dice, 1932: 5–7, 19–22). The two following skull measurements, however, have not previously been taken.

Length of nasals. From most anterior part of either nasal to the most posterior extension of that nasal in the median line of the skull.

Zygomatic breadth. Greatest width of skull across the zygomatic processes of the temporal bones.

The external measurements have all been made by myself. The bones have been measured by Norman Andersen, Norman Auerbach, R. M. Bailey, E. R. Cady, Eugene Olmsted, and Carolyn Sheldon. The tint photometer readings are by J. D. Karp, Herbert MacDonough, Roger Ridley, Paul Schulz, and Palmer Sime. The statistical calculations were made by Don Hayne, Margaret Liebe, Ray Moree, Merrel Taylor, and myself.

Statistical comparisons between means have been made in general by the method developed by Leraas and myself (Dice and Leraas, 1936). Differences between two means which are greater than about 2.7 times the standard error of their difference are by this method assumed to be statistically significant.

Several of the stocks proved relatively infertile in the laboratory, and the number of specimens of one-year old mice available in the Lick Creek and Lyons Ferry North stock is considerably less than in the other stocks. Furthermore, the parents of the laboratory-bred stocks from Troy, Pullman, Lyons Ferry North, and Lick Creek consisted of a single pair each, and the Lyons Ferry South stock had only three parents. For these stocks therefore there is the likelihood that the means given may not represent the exact average character of the populations at the places where the stocks were secured.

STOCKS OF MICE

The stock of deer-mice from Palouse Falls (Map 1) was secured and donated by Arthur and Ruth Svihla. All the other stocks described in this report were trapped by myself. My brother, Carl E. Dice, assisted in securing the Lick Creek stock. The elevations above sea level were mostly determined by an altimeter checked with known elevations, but some data were kindly furnished by the Northern Pacific Railway Company.

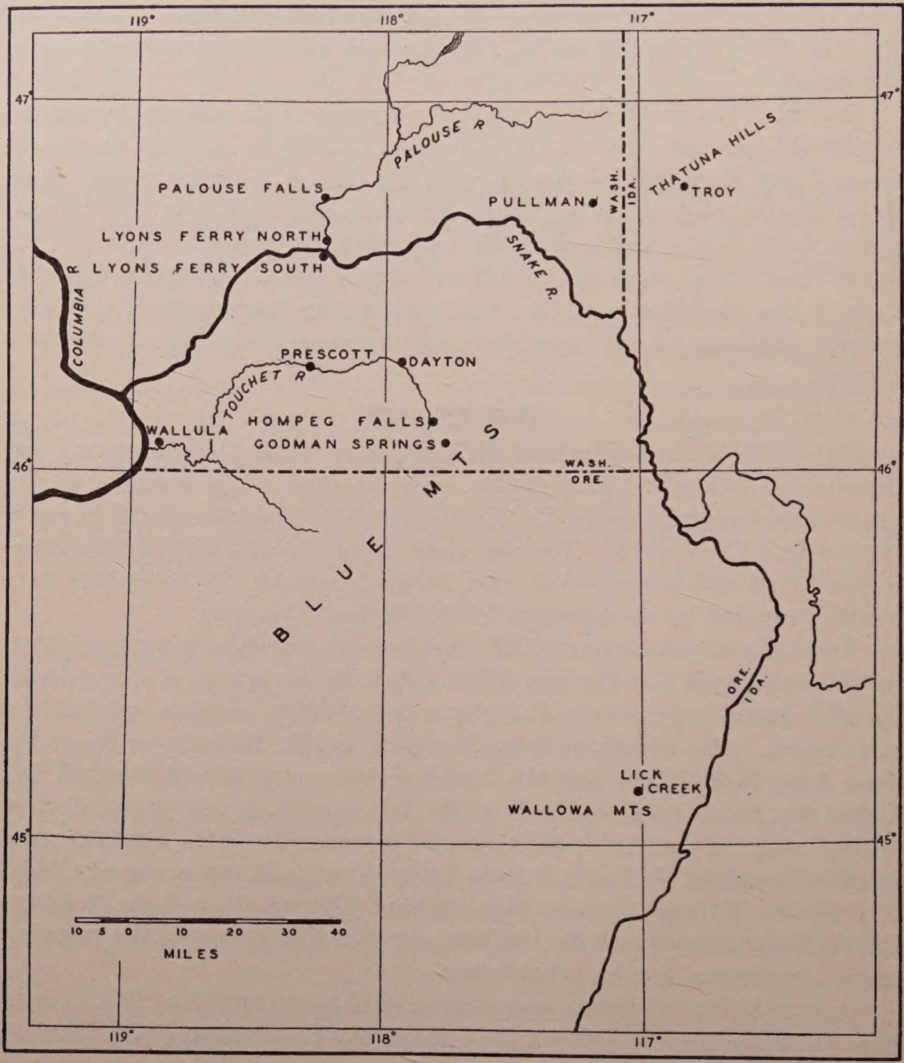
Troy. In the summer of 1928, twenty-three individuals were captured on a low ridge of the Thatuna Hills, five miles northwest of Troy, Latah County, Idaho. Here brush had grown up following clearing and fire in a pine forest. The elevation of the Northern Pacific Railway tracks at the Troy depot is 2473 feet, and the trapping station was several hundred feet higher than this. Only one pair of the field-caught animals proved fertile.

Pullman. A single pair of deer-mice was secured in late July, 1928, on a brushy slope along the South Palouse Valley, a half mile east of the city limits of Pullman, Whitman County, Washington. The elevation of the Northern Pacific Railway tracks at the Pullman depot is 2357 feet, and the trapping station was several hundred feet higher.

Palouse Falls. Eighteen mice were secured in the spring of 1931 in open bunch grass on the west shore of the Palouse River at Palouse Falls, Franklin County, Washington.

Lyons Ferry North. Taken in August, 1928, mostly along rocky bluffs on the western side of Palouse River, in Franklin County, Washington, between one and two miles above the junction of the Palouse River with Snake River at Lyons Ferry. The elevation of the Northern Pacific Railway tracks at the siding of Perry, located a hundred feet or more lower than the trapping station, is 524 feet. All of the laboratory-bred mice are the offspring of a single pair. Among the later inbred descendents of this stock appeared behavior abnormalities which have been classed as waltzing and epilepsy (Dice, 1935: 25–34).

Lyons Ferry South. Along the rocky bluffs on the south side of Snake River, at Lyons Ferry, Walla Walla County, Washington, two females and one male were secured in August, 1928. The elevation of the trapping station is practically the same as that of Lyons Ferry North.



Map 1. Part of the Columbia Basin, in Washington, Oregon, and Idaho, with localities from which stocks of deer-mice for this study have been collected.

Wallula. Five females and six males were trapped in a grove of willows along the Walla Walla River, in Walla Walla County, three miles east of Wallula, Washington, in September, 1932. The elevation at the collecting station is about 325 feet above sea level.

Prescott. In a willow-cottonwood association along the Touchet River, two miles east of Prescott, Walla Walla County, Washington, forty-nine females and sixty-nine males were trapped alive during the summer of 1928. At the collecting station the elevation is 1100 feet.

Dayton. Four females and five males were taken in August, 1932, in willow-cottonwood association along the North Fork of the Touchet River, three miles southeast of Dayton, Columbia County, Washington. The altimeter reading at the collecting station was 1720 feet.

Hompeg Falls. In August, 1932, six females and seven males were taken in lowland fir association in the canyon of the North Fork of the Touchet River at Hompeg Falls, thirteen miles in a direct line southeast of Dayton, Columbia County, Washington. The elevation is three thousand feet above sea level. Although only about five miles in a direct line from the collecting station at Godman, which is on the ridge above, there is a difference in elevation between the two places of 2700 feet.

Godman. In August, 1928, eleven females and fourteen males were trapped mostly in buckbrush association at Godman Springs Ranger Station, along the ridge of the Blue Mountains, eighteen miles in a direct line southeast of Dayton, Columbia County, Washington. The elevation of the trapping station averaged about 5700 feet.

Lick Creek. In early August, 1928, eight females and four males were trapped at Lick Creek Ranger Station, in the Wallowa Mountains of Malheur County, Oregon, sixteen miles in a direct line southeast of Joseph. This is in yellow pine forest, but the elevation above sea level is unknown. Only a single pair of the field-caught animals produced offspring.

VARIATION IN DIMENSIONS OF BODY AND SKELETON

The differences in the size of the various parts of the body and skeleton between the several stocks here described are for certain measurements of considerable amount and of high statistical significance. These differences between the stocks, furthermore, must be caused by differences in heredity, for the mice compared are all laboratory-bred and are all of comparable age.

In the following comparisons the term *large* applied to a particular stock indicates that its mean for the particular measurement under consideration is not significantly exceeded by the mean of any other stock. Similarly, a *small* stock in any given measurement is one which does not significantly exceed the stock having the smallest mean. *Intermediate* stocks are those which have significantly smaller means than the largest mean, and significantly larger means than the smallest mean.

In body length the stocks with the largest means are those from Palouse Falls, Dayton, and Wallula. These stocks do not differ significantly from one another in this measurement. Stocks which are intermediate in body length, in order of decreasing size, are those from Troy, Hompeg Falls, Lyons Ferry North, Godman, Lyons Ferry South, Lick Creek, and Pullman. Some of these intermediate stocks differ significantly from some of the stocks having the largest body lengths, and some of the intermediate stocks differ significantly from other intermediate stocks, but there is no obvious break anywhere in the series. All these intermediate stocks significantly exceed the Prescott stock, which has the shortest average body length of all.

The tails average longest in the stocks from Lyons Ferry North, Godman, Troy, and Pullman. These stocks do not differ significantly from one another in this measurement, except that the Lyons Ferry North stock significantly exceeds the Pullman stock. Each of these stocks significantly exceeds in tail length all remaining stocks. The stocks from Dayton, Prescott, Hompeg Falls, Lyons Ferry South, Palouse Falls, and Wallula form an intermediate group, and no one of these stocks differs significantly from any other in the group. All intermediate stocks significantly exceed the stock from Lick Creek, which has the shortest tail length of all.

In length of hind foot the stocks from Hompeg Falls, Godman, Wallula, Pullman, and Dayton average largest, and there are no differences of statistical significance between these four stocks. An intermediate group is composed of the stocks from Palouse Falls, Troy, Lick Creek, Lyons Ferry North, and Prescott. This group is not sharply separated from the group of stocks having large feet. All the intermediate stocks significantly exceed in foot length the Lyons Ferry South stock, which has the shortest feet of all.

The ears of the Palouse Falls, Godman, Hompeg Falls, Pullman, and Dayton stocks are all large. Ears of intermediate length are possessed by the stocks from Troy, Lyons Ferry North, Prescott, and Wallula. All these stocks significantly exceed the Lick Creek stock in ear length. The Lick Creek stock in its turn has significantly longer ears than the Lyon Ferry South stock, which has the smallest ears of all the stocks.

In length of femur the Lyons Ferry North stock significantly exceeds all of the others. Stocks intermediate in this measurement are those from Palouse Falls, Pullman, Dayton, Troy, Wallula, and Godman. The Lyons Ferry South, Prescott, Hompeg Falls, and Lick Creek stocks average small in femur length. These small stocks have significantly shorter femurs than the intermediate stocks, except that the Lyons Ferry South stock does not differ significantly from the Wallula or Godman stocks nor the Prescott stock from the Godman stock.

The mandible is longest in the stocks from Pullman, Palouse Falls, Wallula, Dayton, and Hompeg Falls. The stocks from Troy, Godman, and Lyons Ferry North are intermediate in this measurement. The intermediate stocks all are significantly shorter in length of mandible than the Pullman and Palouse Falls stocks, but the Troy stock does not differ significantly from the Wallula stock, and none of the intermediate stocks differ significantly from the Dayton and Hompeg Falls stocks. All the intermediate stocks significantly exceed the stocks from Lick Creek, Prescott, and Lyons Ferry South, which have the shortest mandibles.

The length of skull from condyle to front extension of the premaxilla is greatest in the stocks from Lyons Ferry North, Palouse Falls, Hompeg Falls, Pullman, and Godman. The stocks from Troy, Dayton, and Wallula are intermediate in this measurement. All the intermediate stocks differ significantly from the Lyons Ferry North, Palouse Falls, and Hompeg Falls stocks, but not from the Pullman and Godman stocks. All the intermediate stocks significantly exceed the stocks from Lick Creek, Lyons Ferry South, and Prescott, which have the shortest skulls.

The distance from the condyle to the anterior edge of the zygomatic process of the maxilla averages large in the stocks from Troy, Pullman, Palouse Falls, Lyons Ferry North, and Hompeg Falls. The stocks from Godman, Dayton, and Wallula are intermediate in size. All of the intermediate stocks are significantly shorter in this measurement than the Troy and Palouse Falls stocks, and the Wallula stock also is significantly shorter than the Pullman stock, but there are no other significant differences between the large and intermediate groups of stocks. All the intermediate stocks significantly exceed in this measurement the stocks from Prescott, Lyons Ferry South, and Lick Creek, which are smallest of all.

In bullar width of skull the stocks from Hompeg Falls, Lyons Ferry North, and Wallula average large, and those from Palouse Falls, Pullman, and Godman are intermediate. The stocks from Dayton, Lick Creek, Prescott, Troy, and Lyons Ferry South average small. In this measurement the stocks form a somewhat graded series, with no sharp break between the groups at any place.

The length of nasals averages large in the stocks from Pullman, Palouse Falls, Lick Creek, and Dayton, and intermediate in those from Troy, Wallula, Hompeg Falls, and Godman. All the intermediate stocks are significantly exceeded by the stocks from Pullman and Palouse Falls, but there are no other significant differences between the stocks of the large and the intermediate groups. The intermediate stocks all significantly exceed the stocks from Lyons Ferry South and Prescott, which have the shortest nasals of all. The nasals of the Lyons Ferry North stock were not measured, because of the small number of specimens.

The zygomatic breadth of the skull averages large in the stocks from Palouse Falls, Dayton, and Pullman; intermediate in those from Lick Creek, Godman Springs, Wallula, and Hompeg Falls; and small in those from Prescott, Lyons Ferry South, and Troy. In this measurement also the stocks form a graded series, with no sharp break between any of the size groups. The zygomatic breadth of the Lyons Ferry North stock was not measured.

The stocks having the smallest dimensions in general are the two from Lyons Ferry South and Prescott (Table I). Neither of these stocks ranks large among the eleven stocks here compared, for any measurement. The Prescott stock is intermediate among the stocks in tail length and ear length. In length of hind foot it is significantly larger than the Lyons Ferry South stock,

TABLE I

VARIATION IN DIMENSIONS OF *PEROMYSCUS MANICULATUS* FROM THE COLUMBIA BASIN

Means and standard errors of measurements of 1-year age class, in millimeters

Stock	Number of Specimens	Average Age, Weeks	Number of Parents	Body Length	Tail Length	Foot Length	Ear Length
Troy	80	48	2	93.36 ± .38	79.54 ± .49	20.099 ± .083	17.526 ± .081
Pullman	34	57	2	90.00 ± .68	77.55 ± .73	20.168 ± .087	17.835 ± .090
Palouse Falls	96	57	11	96.71 ± .40	71.02 ± .45	20.087 ± .056	17.944 ± .077
Lyons Ferry N.	18	50	2	91.76 ± .94	81.29 ± 1.00	19.961 ± .122	17.512 ± .130
Lyons Ferry S.	97	53	3	90.86 ± .40	71.41 ± .52	19.114 ± .062	16.088 ± .070
Wallula	90	56	7	94.77 ± .40	70.25 ± .46	20.236 ± .071	17.252 ± .071
Prescott	65	44	24	85.88 ± .55	72.44 ± .80	19.568 ± .099	17.309 ± .074
Dayton	45	57	9	96.67 ± .72	73.02 ± .95	20.151 ± .114	17.829 ± .144
Hompeg Falls	61	61	6	93.00 ± .62	71.95 ± .66	20.454 ± .085	17.849 ± .108
Godman	68	57	13	90.97 ± .54	80.07 ± .58	20.296 ± .080	17.871 ± .082
Lick Creek	25	55	2	90.64 ± .55	67.36 ± .72	19.992 ± .107	16.728 ± .106

Stock	Femur	Mandible	Condyle-Premaxilla	Condyle-Zygoma	Bullar Width	Nasal Length	Zygomatic Breadth
Troy	15.960 ± .059	15.876 ± .049	24.347 ± .065	17.541 ± .047	10.576 ± .023	10.603 ± .048	12.647 ± .040
Pullman	16.100 ± .124	16.209 ± .082	24.556 ± .110	17.506 ± .068	10.745 ± .027	10.917 ± .075	13.025 ± .050
Palouse Falls	16.146 ± .069	16.135 ± .045	24.683 ± .062	17.501 ± .040	10.808 ± .025	10.837 ± .041	13.182 ± .044
Lyons Ferry N.	16.667 ± .107	15.747 ± .089	24.814 ± .131	17.493 ± .100	10.893 ± .057	....	....
Lyons Ferry S.	15.550 ± .083	15.262 ± .050	23.603 ± .068	16.831 ± .059	10.519 ± .027	10.058 ± .043	12.681 ± .043
Wallula	15.859 ± .078	15.986 ± .043	24.318 ± .060	17.272 ± .041	10.869 ± .031	10.573 ± .052	12.875 ± .044
Prescott	15.398 ± .102	15.296 ± .062	23.480 ± .094	16.908 ± .075	10.582 ± .037	10.022 ± .037	12.700 ± .043
Dayton	16.048 ± .139	15.958 ± .088	24.319 ± .114	17.295 ± .070	10.659 ± .037	10.672 ± .092	13.118 ± .047
Hompeg Falls	15.328 ± .093	15.936 ± .064	24.670 ± .086	17.359 ± .056	10.920 ± .023	10.565 ± .049	12.830 ± .049
Godman	15.795 ± .098	15.769 ± .047	24.431 ± .068	17.316 ± .046	10.709 ± .027	10.499 ± .060	12.880 ± .033
Lick Creek	15.196 ± .133	15.324 ± .051	23.648 ± .066	16.784 ± .051	10.587 ± .031	10.744 ± .068	12.922 ± .060

though in this measurement it is significantly smaller than most of the other stocks. In all other measurements the Prescott stock ranks small, and in body length it is significantly shorter than any other stock. The Lyons Ferry South stock is intermediate among the stocks in body length and tail length. In all other measurements it ranks small, and in ear length and hind-foot length it is significantly smaller than any other stock.

Both the Lyons Ferry South and Prescott stations are located in moderately arid grassland, and it might therefore be presumed that the small dimensions of these stocks were correlated with their arid habitats. That this is not a true correlation is, however, shown by the fact that the Wallula stock, which comes from a still more arid habitat, ranks generally large in size. The Wallula stock ranks among the largest of the stocks in body length, foot length, length of mandible, and bullar width; for all the other measurements it is intermediate among the stocks; and for no measurement does it rank small.

The Lyons Ferry North stock also ranks large among the stocks, although it comes from the bunch-grass belt just across Snake River from the Lyons Ferry South station. In no measurement does the Lyons Ferry North stock rank small; it is intermediate among the stocks in body length, hind-foot length, ear length, and length of mandible; in all other measurements it ranks large, and in femur length it is significantly larger than any other stock.

The stocks averaging largest in dimensions are those from Pullman, Palouse Falls, Lyons Ferry North, Wallula, and Godman. No one of these stocks ranks small in any measurement, but all rank large or intermediate. Of these stocks, however, none ranks large in all measurements, nor do all these stocks rank large for any one measurement.

The large size of these stocks does not seem to be correlated with climatic belt or elevation above sea level. The Godman stock is from a high elevation on the ridge of the Blue Mountains, where coniferous forests prevail, but the Wallula stock, which also is large in size, comes from a low elevation in the sagebrush belt along the Columbia River. The other stocks of which the measurements average large were taken at intermediate elevations in the bunch-grass belt.

The remaining stocks, consisting of those from Troy, Dayton, Hompeg Falls, and Lick Creek, may be considered to be intermediate in size of body and skeleton. All of these stocks rank large in certain dimensions, intermediate in others, and small in still others. The Lick Creek stock, however, ranks large only in length of nasals; the Dayton stock ranks small only in bullar width; and the Hompeg Falls stock ranks small only in length of femur.

Furthermore, for no individual measurement is there any consistent difference between the stocks from the mountain forests and those from bunch grass and sagebrush at lower elevations. The differences in measurements between the several stocks seem to lack any correlation with environmental conditions. Long skulls or long tails seem as likely to occur in stocks from arid habitats as in those from the mountain forests. This conclusion agrees with the results of a study by Leraas (1938: 1–13) of variation in the deermouse on the northern slope of the Uinta Mountains in Utah.

Some of these stocks, may, as has previously been pointed out, not fully represent the characters of the populations living at their collecting stations, because of the small number of parents which produced the laboratory-bred animals. This doubt applies to the stocks from Troy, Pullman, Lyons Ferry North, and Lick Creek, each of which was produced by a single pair of field-caught animals. The Lyons Ferry South stock was derived from only three field-caught parents.

It will be noted that three of these stocks come from north of Snake River. If all stocks from north of Snake River, including the Palouse Falls stock, and also the Lyons Ferry South and Lick Creek stocks from south of the river are temporarily omitted from consideration, there remain five stocks, the collecting stations of which form a transect from the Columbia River to the top of the Blue Mountains in the following order: Wallula, Prescott, Dayton, Hompeg Falls, and Godman. The laboratory-bred animals in each of these stocks were the offspring of what is believed to be a sufficient number of field-caught parents to represent adequately the variability of the populations from which each series was taken.

The Wallula and Godman stocks, which come from the lowest and highest elevations, respectively, both average large among the stocks in measurements, and neither ranks small in any dimension. The Prescott stock, which comes from the intermediate bunch-grass belt, ranks smallest of these five stocks, and is not relatively large for any measurement. The Dayton and Hompeg Falls stocks both rank moderately large in their measurements, for each of them ranks small in only one measurement.

Of the individual measurements only length of ear shows a possible correlation with climatic belt. In ear length the Godman, Hompeg Falls, and Dayton stocks average significantly larger than the Prescott and Wallula stocks, which rank intermediate among the whole number of stocks. There is considerable question whether this difference has any great importance, because the Palouse Falls stock, which comes from the intermediate bunch-grass belt north of Snake River, has the greatest average ear length of all the stocks, though it does not significantly exceed in this measurement either the Godman, Hompeg Falls, or Dayton stocks. For no other measurement is there any indication of a consistent difference between the measurements of the stocks from different life belts.

Sumner (1923: 243–44) also failed to find a correlation between the body size or proportions of *Peromyscus* and any character of the environment, though he points out that over wide expanses of territory fairly consistent trends may occur.

In areas where coniferous or deciduous forests cover a wide territory, it is possible that some particular type of body proportion may be correlated with the resulting semiarboreal habit of the deer-mice. In the part of the Columbia Basin under consideration, however, where the forests in general are rather thin, and where they alternate with bunch grass and with sagebrush, no special character of body size or body proportion distinguishes the deer-mouse populations inhabiting any particular vegetation type.

VARIATION IN PELAGE COLOR

Each of the stocks of deer-mice from the Columbia Basin exhibits a moderate amount of variability in pelage color; some individuals are darker and some paler than are the majority of the specimens making up the stock (Table II).

The only abnormality in color which has been detected appeared in the Prescott stock and was evidently produced by a dilution factor. The three specimens of the Prescott stock which show the dilute character all agree in having all colored parts of the hairs paler than normal. On the upper parts of the body the bases of the hairs are a dilute gray in tone, the colored subterminal bands of the hairs are dilute slaty buff, and none of the hairs are black or have black tips. In general appearance the upper parts of these mice are a slate color with a strong tinge of buff. The first individual in our stocks showing the dilute character was two generations of brother-sister matings removed from the field-caught mice. This individual, a male, was mated to his mother and two out of three of their offspring showed the dilute character. Because of infertility in the stock the character has been lost. The evidence indicates the dilution character to be inherited as a simple Mendelian recessive.

In color tone of the dorsal stripe the Wallula stock is palest of all the Columbia Basin stocks. Its tint photometer readings average significantly higher than those of any other stock, except the Lyons Ferry South stock for red. The Lyons Ferry South stock, in its turn, significantly exceeds all remaining stocks in tint photometer readings, except the Lick Creek stock for peacock blue. The Prescott and Lick Creek stocks, which are next highest in readings, do not differ significantly from one another for any color screen, and the Prescott stock significantly exceeds the Lyons Ferry North stock only in the readings for yellow. The Prescott stock significantly exceeds the Palouse Falls stock in readings for peacock blue and blue-violet, but these two stocks do not differ significantly in the readings for red, yellow, or green.

The darkest pelage color on the dorsal stripe is exhibited by the Pullman stock, which has significantly lower tint photometer readings than any other stock, except that it does not differ significantly from the Dayton stock in readings for peacock blue and blue-violet. The Dayton and Hompeg Falls stocks, which are next to the darkest in pelage color, do not differ significantly from one another for any color screen. The Hompeg Falls stock does not differ significantly from the Troy stock in readings for any color screen, but the Dayton stock has significantly lower readings than the Troy stock for pea-

TABLE II

Pelage Color of *Peromyscus maniculatus* from the Columbia Basin

Mean tint photometer readings and standard errors of 1-year age class, in per cent

Stock	Dorsal Stripe				
	Red	Yellow	Green	Peacock Blue	Blue-violet
Troy	6.31 ± .15	5.35 ± .14	4.53 ± .11	3.96 ± .10	3.51 ± .09
Pullman	4.73 ± .12	4.40 ± .15	3.47 ± .14	3.07 ± .11	2.60 ± .12
Palouse Falls	7.43 ± .22	6.05 ± .17	5.15 ± .16	4.06 ± .11	3.60 ± .11
Lyons Ferry N.	7.00 ± .42	5.61 ± .36	5.00 ± .32	4.22 ± .32	3.89 ± .26
Lyons Ferry S.	9.48 ± .20	7.87 ± .16	6.65 ± .15	5.63 ± .13	5.10 ± .12
Wallula	9.85 ± .22	8.69 ± .21	7.65 ± .21	6.40 ± .19	5.77 ± .18
Prescott	7.98 ± .24	6.71 ± .19	5.61 ± .17	4.87 ± .14	4.40 ± .15
Dayton	5.89 ± .23	5.13 ± .20	4.20 ± .17	3.47 ± .13	3.09 ± .12
Hompeg Falls	6.18 ± .13	5.26 ± .10	4.43 ± .10	3.87 ± .08	3.43 ± .08
Godman	6.99 ± .22	5.72 ± .16	4.91 ± .15	4.00 ± .12	3.64 ± .12
Lick Creek	7.36 ± .43	6.32 ± .32	5.56 ± .32	5.00 ± .28	4.28 ± .21

Stock	Side				
	Red	Yellow	Green	Peacock Blue	Blue-violet
Troy	14.35 ± .23	12.61 ± .19	10.28 ± .16	8.48 ± .15	7.61 ± .13
Pullman	10.50 ± .23	9.90 ± .22	7.80 ± .18	6.93 ± .17	5.83 ± .16
Palouse Falls	16.31 ± .27	13.66 ± .22	11.71 ± .19	9.28 ± .15	8.21 ± .15
Lyons Ferry N.	16.11 ± .44	13.11 ± .37	11.61 ± .34	9.33 ± .26	8.67 ± .25
Lyons Ferry S.	20.24 ± .29	17.04 ± .26	14.24 ± .23	12.05 ± .21	10.73 ± .20
Wallula	19.00 ± .38	16.48 ± .36	14.38 ± .35	12.04 ± .31	10.79 ± .29
Prescott	16.31 ± .26	14.23 ± .23	11.84 ± .20	9.97 ± .19	9.02 ± .21
Dayton	13.56 ± .25	12.27 ± .24	9.64 ± .18	8.07 ± .17	6.73 ± .15
Hompeg Falls	12.98 ± .19	11.16 ± .17	9.38 ± .13	8.10 ± .12	7.39 ± .11
Godman	15.06 ± .25	12.57 ± .20	10.64 ± .18	8.66 ± .15	7.63 ± .15
Lick Creek	15.48 ± .36	13.64 ± .36	11.64 ± .31	9.72 ± .28	8.72 ± .27

cock blue and blue-violet. The Troy stock does not differ significantly from the Godman or Lyons Ferry North stocks for any color screen, but the Hompeg Falls stock has significantly lower readings than the Godman stock for red.

Of the stocks which are intermediate in color tone of the dorsal stripe the Lyons Ferry North, Palouse Falls, and Godman stocks do not differ from one another significantly in tint photometer readings for any color screen. The Lick Creek stock also does not differ significantly from any of these three stocks, except that its tint photometer readings significantly exceed those of the Godman stock for peacock blue and of the Palouse Falls stock for peacock blue and blue-violet.

In tone of color on the side of the body the Columbia Basin stocks fall in much the same order as they do for the dorsal stripe. The Lyons Ferry South and Wallula stocks are palest in color. These two stocks do not differ significantly from one another in tint photometer readings, but both significantly exceed all the other stocks. The Prescott, Palouse Falls, Lick Creek, and Lyons Ferry North stocks, which are next darker in color tone, do not differ significantly from one another in readings, except that the Prescott stock significantly exceeds the Palouse Falls stock for peacock blue and blue-violet.

The darkest stock in color of the side is the one from Pullman, whose tint photometer readings are significantly lower than those of any other stock. The two next paler stocks are those from Hompeg Falls and Dayton. These two stocks do not differ significantly from one another in tint photometer readings, except that the Hompeg Falls stock is significantly the lower for yellow and the Dayton stock is significantly the lower for blue-violet. The Godman and Troy stocks, which are still paler in side color, do not differ significantly from each other in color readings. The Troy stock significantly exceeds the Hompeg Falls stock in tint photometer readings for red, yellow, and green, but significantly exceeds the Dayton stock only for blue-violet. The Godman stock significantly exceeds the Hompeg Falls stock in readings for all color screens except blue-violet, and the Dayton stock for all screens except yellow.

Of the stocks which are intermediate in color tone of the side of the body the Troy stock has significantly lower tint photometer readings than the Lyons Ferry North stock for all color screens except yellow, and significantly lower readings than the Palouse Falls stock for all screens except peacock blue. The readings of the Troy stock are, furthermore, significantly lower than those of the Lick Creek stock for green, peacock blue, and blue-violet. The Godman stock has significantly lower readings than the Lyons Ferry North and Palouse Falls stocks for all color screens except blue-violet, and has significantly lower readings than the Lick Creek stock for green, peacock blue, and blue-violet.

Accordingly, the general pelage color of the Columbia Basin stocks may be said to be palest in the stocks from Wallula and Lyons Ferry South. The stocks from Prescott and Lick Creek are also rather pale. The Pullman stock is darkest in pelage color, and the Dayton and Hompeg Falls stocks are somewhat less dark. The stocks from Palouse Falls, Lyons Ferry North, Godman, and Troy are, in general, intermediate in color tone, though their readings through certain color screens do not differ significantly from the readings of stocks which are here considered to be moderately pale or moderately dark in color tone.

CORRELATION BETWEEN PELAGE COLOR AND ENVIRONMENT

The pelage color of the deer-mice of the several stocks available from the Columbia Basin seems to be correlated more or less directly with the climatic belts of the area and also with the shade of color of the surface soils.

The palest deer-mice from south of Snake River are those from Wallula and from Lyons Ferry South. Both of these stocks have relatively high tint photometer readings, both for the dorsal stripe and for the side of the body. The Wallula stock is from willow association in the sagebrush belt near the Columbia River. The willow association is itself only moderately arid, for it borders the Walla Walla River, but the deer-mice which occur here probably range over the adjacent sagebrush association. The Lyons Ferry South stock was mostly taken beside rock bluffs in the hot and arid Snake River Canyon, in the bunch-grass belt. The Wallula and Lyons Ferry South stocks do not differ significantly from one another in color tone of the side of the body, but the Wallula stock is paler and somewhat less buffy in color of the dorsal stripe than is the Lyons Ferry South stock.

The stocks from Prescott, Lick Creek, and Godman are intermediate in shade of pelage color. The Prescott stock is from willow-cottonwood association along the Touchet River in the bunch-grass belt. The Godman stock is from the ridge of the Blue Mountains where the habitat is moderately arid, and the Lick Creek stock is from moderately arid yellow pine forest along the north base of the Wallowa Mountains. The Prescott and Lick Creek stocks do not differ significantly in tint photometer readings for any color screen, either on the dorsal stripe or on side of the body, but the Prescott stock significantly exceeds the Godman stock for all color screens. Only for a few color screens does the Lick Creek significantly exceed in tint photometer readings the Godman stock.

The darkest of the stocks from south of Snake River are those from Dayton and from Hompeg Falls. Both of these localities lie in the Blue Mountains. The Dayton stock was taken in willow-cottonwood association in the bottom of the small valley of the North Fork of the Touchet River, and the Hompeg Falls stock was taken in lowland fir association in the canyon of the North Fork of the Touchet River, deep in the mountains. The Hompeg Falls collecting station is in the most dense forest and on soil containing the greatest amount of humus to be found in the area. The Dayton station is at the edge of the mountains, and the near-by slopes are mostly bare of trees, but the alluvial soil in the valley is filled with humus washed from the mountains. There is no significant difference in color readings between the Hompeg Falls and Dayton stocks, except that in the readings for side color the Dayton stock significantly exceeds the Hompeg Falls stock for green and the Hompeg Falls stock significantly exceeds the Dayton stock for blue-violet.

The stocks from north of the Snake River do not have so great differences in shade of pelage color as those from south of the river, but the same tendency for pale pelage color to occur in arid habitats is evident.

The two stocks from Palouse Falls and Lyons Ferry North are the palest in pelage color of this group of stocks. The Palouse Falls stock is from open bunch-grass habitat, whereas the Lyons Ferry North stock is mostly from rock cliffs along the lower Palouse River. These two stocks do not differ significantly from one another in tint photometer readings.

The stock from Troy in the Thatuna Hills of Idaho is intermediate in tone of pelage color. It has significantly lower tint photometer readings than has the Palouse Falls stock on the side of the body for all color screens and on the dorsal stripe for all color screens except peacock blue and blue-violet. From the Lyons Ferry North stock the differences in color readings are not significant for the dorsal stripe but are significant for the side of the body for all color screens except yellow.

The Pullman stock has the darkest pelage of all stocks from north of Snake River, and its tint photometer readings are significantly lower than those of any other stock considered in this report. The Pullman stock was secured in moderately arid shrubs along the steep side of the valley of the South Fork of the Palouse River.

In these stocks from north of Snake River the palest pelage colors are exhibited by the mice from the arid part of the bunch-grass belt, but the mice from Pullman, in the more humid part of the bunch-grass belt, are darker in pelage than the mice from Troy, which is in the montane belt. However, only single stocks are available from the humid part of the bunch-grass belt and from the montane belt, and the laboratory-bred mice of each of these stocks were descended from a single pair of field-caught ancestors. The laboratory-bred animals, therefore, of the Pullman and Troy stocks may not represent the average color heredity of the populations at the two respective collecting localities.

If those Columbia Basin stocks which were produced in the laboratory from an inadequate number of parents are omitted from consideration, a definite correlation between climatic belt and pelage color is found in the remaining stocks. The Hompeg Falls and Godman stocks from the Blue Mountains and the Dayton stock from the base of the mountains are generally darker than the Prescott and Palouse Falls stocks of the bunch-grass belt, and the Wallula stock from the sagebrush belt is the palest of all these stocks.

A more specific relationship to an environmental factor is shown by the correlation between the pelage color of these deer-mice and the color of the surface soil of their habitats. The shade of color exhibited by the surface soil of any habitat is in large part determined by the included amount of humus. The amount of humus accumulated in the soil is usually greatest in moist climates, because there the growth of vegetation is heaviest (Dice and Blossom, 1937 : 106–8). In our region the montane belt has the darkest and the sagebrush belt the palest soils (Table III).

Samples of surface soil for color analysis are available only from Wallula, Prescott, and Hompeg Falls. The samples from Prescott and from Hompeg Falls were collected in the same stations where the mice were captured. The Wallula sample was collected several miles east of the trapping station but is believed to be typical of the soils of the lower Walla Walla Valley.

For the three stations from which soil samples are available the soil color at Hompeg Falls is the darkest in tone. The Wallula soil is palest, and that of the Prescott station is intermediate in shade. In Table III are given only

TABLE III

PELAGE COLOR OF *PEROMYSCUS MANICULATUS* COMPARED TO SOIL COLOR
Mean tint photometer readings for red, in per cent

Stock	Pelage		Surface Soil
	Dorsal Stripe	Side	
Wallula	9.85	19.00	25.25
Prescott	7.98	16.31	15.50
Hompeg Falls	6.18	12.98	8.25

the mean readings for red, but the same relationships hold for the other color screens.

The pelage color of the mice for the stocks available from the Columbia Basin south of Snake River has been shown above also to be darkest at Hompeg Falls and palest at Wallula, and the mice from Prescott are intermediate in color tone. The darkest pelage, therefore, occurs on the mice which live on dark soil; the palest pelage is shown by the mice which live on pale soil; and the mice which live on soil intermediate in color tone are intermediate in pelage color.

The correlation between pelage color and soil color in these deer-mice is not exact and, of course, could not be because of the difference in shade of pelage color between the dorsal stripe and side of the mice. The average readings for red of the soil from Hompeg Falls and from Prescott fall between the average readings for the dorsal stripe and for the side of the body of the mice coming from these two places (Table III). The soil representing the Wallula station, on the contrary, is paler in color, as shown by higher tint photometer readings, than either the dorsal stripe or side of the Wallula mice.

The trend in the deer-mice of the Columbia Basin for dark pelage to occur on dark soils and in humid climates and for pale pelage to occur on pale soils and in arid climates parallels the trend in other regions toward a correlation between the pelage colors of the small mammals and the characters of their environment (Dice and Blossom, 1937: 92–108).

SNAKE RIVER—A BARRIER TO DISTRIBUTION

Snake River is a fast-flowing, relatively shallow stream with many rapids. Its width at Lyons Ferry is about one-fourth mile. That a deer-mouse would be able to swim across the stream is extremely unlikely. In this part of its course it is very doubtful if the river ever freezes over completely. Farther upstream, in southern Idaho, Snake River does sometimes freeze over, and there it is not a barrier to the distribution of *Peromyscus maniculatus;* the same subspecies, *sonoriensis,* occurs on both sides (Davis, 1939: 52–59, 288–93).

Except at its lower end, near its junction with the Columbia, Snake River flows in a deep rocky canyon. Meanders are lacking, and changes in the course of the stream which would result in the transfer of bits of land from one side of the river to the other must be extremely rare, if they ever occur. Occasionally a piece of driftwood originating on one side of the Snake River possibly may come to rest on the opposite side, and it is further possible that such a piece of drift might ferry a deer-mouse across the stream. It is obvious, however, that transfers of this sort must be too infrequent to have any appreciable effect toward making the genetic constitutions of the populations of deer-mice uniform on the two sides of the river. It is certain, therefore, that in this region Snake River is an important barrier to the distribution of deer-mice and probably of other small mammals.

The time of origin of Snake River is not known with certainty, but the stream has been in existence for at least a long period of geologic time. It must have antedated the uplift of the Blue Mountains, through the northern part of which it has cut a deep canyon. The elevation of the Blue Mountains is believed to have been completed before the close of the Miocene (Dice, 1916: 296). For the whole period of their existence the Blue Mountains, therefore, so far as deer-mice are concerned, must have been isolated by the barrier of Snake River from the mountains to the north and east. It might, therefore, be expected that the deer-mice from south of Snake River would show considerably different characters from those living on the north side of the stream.

Two of our stocks of deer-mice, Lyons Ferry North and Lyons Ferry South, come from opposite sides of Snake River. The two collecting stations are at the same elevation and have similar environmental features. These stations are not more than three miles distant from one another in an air line. Some inbreeding was involved in the production of both these laboratory stocks, for the North stock was descended from only two field-caught individuals, and the South stock from only three individuals. The field-caught mice of these two stocks differ, however, in the same way as do the laboratory-bred animals, and it is believed that the differences in characters between the two stocks represent in most part actual differences in the characters of the two respective wild populations.

The Lyons Ferry North stock, coming from the northern side of Snake River, has significantly larger means than the South stock for every measurement of body and skeleton except body length. For most of the measurements the differences between the two stocks are considerable. For tail length the difference is 9.88 ± 1.13 mm., and for condylo-premaxillary skull length the difference is 1.211 ± .148 mm. In pelage color the Lyons Ferry North stock is considerably darker than the South stock. For both dorsal stripe and side and for every color screen the differences between the two stocks in tint photometer readings are of statistical significance.

These important differences in body dimensions and in pelage color between the populations of deer-mice living on the north and the south sides, respectively, of Snake River at Lyons Ferry show conclusively that the river is a barrier to the distribution of these animals. When, however, all the stocks of deer-mice from north of Snake River are compared with all the stocks from south of the river, the differences between the mice from opposite sides of the river are not as consistent as might be expected.

In dimensions of the body and skeleton the stocks from Lyons Ferry North, Palouse Falls, and Pullman, from north of Snake River, all rank large or intermediate among the stocks here described. On the other hand, the Troy stock, which also comes from north of Snake River, ranks small in bullar width and in zygomatic breadth of skull, though in its other measurements this stock ranks intermediate or large. Of the stocks from south of Snake River those from Prescott and Lyons Ferry South rank small or intermediate in all measurements, and the stock from Lick Creek ranks large only in length of nasal. That this does not indicate a generally small size for the stocks from south of Snake River is shown by the fact that the stocks from Wallula and from Godman rank large or intermediate among the stocks in all measurements, that the stock from Hompeg Falls ranks small only in length of femur, and that the stock from Dayton ranks small only in bullar width of skull.

For no single measurement are all the stocks from one side of Snake River significantly larger or smaller than the stocks from the other side of the river.

Both on the north and on the south sides of Snake River the stocks from arid habitats tend, as has been shown earlier in this report, to be paler in pelage than those from habitats having a better cover of vegetation. The result is that the stocks from arid habitats from both sides of the river tend to resemble each other in shade of pelage color. The two stocks, Pullman and Troy, from the most humid habitats north of Snake River resemble the stocks from the humid Blue Mountains south of the river more closely in pelage color than they do the stocks from the arid bunch grass north of the river.

Although the stock from Pullman has the lowest mean tint photometer readings of all the stocks, both on the dorsal stripe and on the side of the body, indicating dark pelage, other stocks from north of Snake River have readings higher than those of some of the stocks from south of the river. Furthermore, although the Wallula and Lyons Ferry South stocks have the highest mean tint photometer readings of all the stocks, other stocks from south of Snake River have lower readings than most of the stocks from north of the river.

No feature of body dimensions or of pelage color seems, therefore, to distinguish the stocks of deer-mice originating north of Snake River from those from south of the river. Although the populations of deer-mice on the two sides of the stream must have been almost entirely separated for perhaps millions of years, or, more likely, since the species has been living in this region, yet no character which is different in the two populations has been found.

The general similarity in the characters of the deer-mice living north and south, respectively, of Snake River, is due, I believe, to the general similarity in environment in the two places. Similar belts of climate and vegetation occur on both sides of the river, and most of the soils are of similar volcanic origin.

The occurrence of pale-colored populations of deer-mice in arid habitats and of dark-colored populations in humid habitats on both sides of Snake River must be the result of parallel evolution. It is, however, impossible to suggest whether the ancestors of the populations of deer-mice on either side of Snake River were pale-colored, dark-colored, or intermediate. Whatever the shade of pelage color of the ancestral stock on each side of the river, the other color types must have later developed, for the local populations on each side of the stream now range in somewhat parallel series from relatively pale to relatively dark in color.

Parallel evolution of body proportions possibly may also have occurred independently in the deer-mice of the two sides of Snake River. Nearly any mean of a given measurement which occurs in a stock on one side of the river can be closely matched by some stock from the opposite side of the stream. There is, however, much variation in the dimensions of the body and skeleton among these stocks of deer-mice, and there is no apparent correlation between any dimension and any character of the environment. Similarities in body dimensions between stocks on opposite sides of Snake River, therefore, may be in considerable part the result of chance. Nevertheless, the measurements of all the deer-mice from both sides of the river fall within certain general limits, which almost certainly are set in part by the environment. The limits of size and of variation in body proportions are nearly alike on both sides of the river probably because the habitats on both sides are largely similar. To this extent it is evident that there has been parallel evolution in body dimensions as well as in pelage color on the two sides of Snake River.

TAXONOMIC RELATIONSHIPS

Two subspecies of *Peromyscus maniculatus* are reported to occur in the area covered by this study. The main part of the range of the subspecies *artemisiae* lies to the northeast of our area, but there are records from eastern Washington, northern Idaho, and northeastern Oregon, from Spokane south to the Blue Mountains and Wallowa Mountains. The subspecies *gambelii* ranges from California north to the interior of Washington east of the Cascade Mountains and extends north as far as Spokane County (Osgood, 1909: 58–61, 67–72; and Taylor and Shaw, 1929: 22).

Peromyscus m. artemisiae is said by Osgood to be slightly darker in color than *gambelii,* and to average larger in size with more elongate skull and longer nasals.

No measurements are available of undoubted *gambelii* reared under laboratory conditions identical with those under which the Columbia Basin stocks were kept. A series of *artemisiae* caught in the field at St. Mary, Montana, and kept two years in the laboratory before being prepared as specimens, has been described by Adolph Murie (1933). These St. Mary specimens are not comparable with the Columbia Basin stocks in dimensions, but they are comparable in pelage color, because there seems to be no important change in pelage color in the deer-mouse between the first and second years of life (Dice, 1932: 22). The St. Mary captive specimens fall within the range of color variation of the stocks from the Columbia Basin, averaging darker than some stocks and paler than others. It is, however, unsafe to assume that the St. Mary specimens are typical in pelage color of the subspecies *artemisiae,* the type locality of which is Ashcroft, British Columbia.

Of the stocks available from the Columbia Basin the darkest in pelage color is the one from Pullman. The stocks which average palest in pelage color are those from Wallula and from Lyons Ferry South. The remaining stocks are intermediate in color tone, and no sharp separation of them into color races is possible. It is, however, apparent that the Hompeg Falls, and Dayton stocks are comparatively dark in color, and that the Prescott and Lick Creek stocks are comparatively pale.

In body length the Palouse Falls, Dayton, Wallula, and Troy stocks average largest of the eleven stocks here compared, and the Prescott stock is the smallest. The other stocks are intermediate in size.

In length of skull the stocks from Lyons Ferry North, Palouse Falls, Hompeg Falls, Pullman, and Godman average large, and the stocks from Lick Creek, Lyons Ferry South, and Prescott average small.

In length of nasals, the other character mentioned by Osgood as being diagnostic between *artemisiae* and *gambelii,* the Pullman, Palouse Falls, Lick Creek, and Dayton stocks average large, and the Lyons Ferry South and Prescott stocks average small.

Of the stocks which are generally pale in pelage color, the Wallula stock has the palest colors of all, but it is large in body length and intermediate in skull length and nasal length. The Lyons Ferry South stock is pale in pelage color and small in skull length and nasal length, but intermediate in body length. The Prescott stock is moderately pale in pelage color and small in all three diagnostic measurements. The Lick Creek stock is moderately pale in pelage color and small in skull length, but is intermediate in body length and large in nasal length.

Of the darker colored stocks the one from Pullman is the darkest, and it also has a long skull and long nasals, but in body length it is intermediate among the stocks. The Hompeg Falls stock is moderately dark in pelage color and has a long skull, but it is intermediate in body length and in length of nasals. The Dayton stock also is moderately dark in pelage color and is large in body length and in nasal length, but it is intermediate in skull length.

Division of the Columbia Basin stocks into subspecies must accordingly depend upon the relative importance placed by the taxonomist upon each of the several diagnostic measurements and upon the color of the pelage. No two criteria give exactly the same classification of the stocks. It has been shown above that the several dimensions of the body and skeleton vary erratically among the stocks, while the variation in pelage color shows a rather definite trend, the stocks from the more arid habitats being generally paler in color and those from the more humid habitats darker in color. It seems necessary, therefore, if a satisfactory division of these stocks into geographic races is to be made that most emphasis be placed on pelage color.

On the basis of pelage color the stocks from Wallula, Lyons Ferry South, Prescott, and Lick Creek may be assigned to the subspecies *gambelii,* and those from Pullman, Hompeg Falls, and Dayton to *artemisiae.* The other stocks are too nearly intermediate in pelage color for division on this basis. The Godman stock comes from the Blue Mountains not far from the collecting stations for the Hompeg Falls and Dayton stocks, which are assigned to *artemisiae.* It ranks large among the stocks in skull length and intermediate in body length and nasal length. From its geographical position and measurements the Godman stock, therefore, may be assigned to *artemisiae.* The Troy stock is generally intermediate among the stocks both in pelage color and in measurements. It, however, may also be assigned to *artemisiae* because of its geographical position within the range of that subspecies. The Palouse Falls stock is intermediate in pelage color, but it ranks large in body length, skull length, and length of nasals. The Lyons Ferry North stock also is intermediate in pelage color; it ranks intermediate in skull length and large in length of skull; and it was not measured for nasal length. It seems best, therefore, on the basis of their measurements to assign both the Palouse Falls and Lyons Ferry North stocks to *artemisiae.*

It is evident that this separation of the stocks of deer-mice available from the Columbia Basin into two subspecies has of necessity been largely arbitrary. There is no sharp line in this area which divides the populations with one set of characters from those with a different set of characters.

No geographical trend is evident in the Columbia Basin stocks for any measurement of the body or skeleton. There are, it is true, considerable differences between the several stocks in average measurements, but the variation seems to be at random and not to follow any geographical order. Especially there seems not to be any correlation among these stocks between the magnitude of any particular dimension and the shade of pelage color of the mice. In using certain measurements to differentiate between the subspecies I have, therefore, depended entirely upon the statements of Osgood, who studied the species over a much broader geographical area than that from which stocks have been available for this investigation.

SUMMARY

The palest pelage colors among the deer-mice from the Columbia Basin are in general exhibited by the stocks from the sagebrush climatic belt and from the more arid part of the bunch-grass belt. The surface soils in these belts are relatively pale in color. The darkest pelage colors are shown by the stocks from the less arid parts of the bunch-grass belt and from the relatively humid montane climatic belt, where the surface soils tend to be dark in color.

No correlation can be detected among the deer-mice here studied, between any dimension of the body or skeleton, and any feature of the environment.

Snake River is a barrier to the movements of deer-mice which has been in existence at least as long a time as the Blue Mountains. The similar pelage colors of the deer-mice living on opposite sides of the river in corresponding life belts must, therefore, have been produced by parallel evolution.

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